

**ABSTRACTS OF STUDENT PRESENTATIONS AND POSTERS  
AT THE FALL 2018 MEETING OF  
THE FLORIDA ORNITHOLOGICAL SOCIETY**

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The Fall 2018 meeting of the Florida Ornithological Society featured a great diversity of oral presentations and posters prepared primarily by students associated with Florida universities. Many of the presentations will likely lead to full-length articles in the near future, but the Abstracts submitted by participants are provided here for members of the Florida Ornithological Society who could not attend the meeting and also to serve as a record the breadth of research underway by the next generation of Florida scientists.

The oral presentations and posters provided by students were organized by Peter Monte (Department of Wildlife Ecology and Conservation, University of Florida). Thanks to Peter for all his hard work. Thanks also to Rindy Anderson, Department of Biological Sciences, Florida Atlantic University, for serving as the local meeting organizer. The Abstracts are listed alphabetically based on the last name of the presenter (who is also listed as the email contact). All authors' affiliated institutions are in Florida unless otherwise noted.

**Homeward bound: Canopy cover and species identity  
influence winter homing success and speed in forest birds**

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Efficient and safe movement is fundamental for wild birds to thrive in the environments where they live. For arboreal forest animals, especially birds, canopy cover has a large impact on daily movements and is an important component of conservation strategies seeking to retain wildlife in disturbed or urban habitats. We translocated

woodland bird of several species utilizing different forest strata during two non-breeding seasons to test their propensity for homing behavior and to examine the effects of canopy cover on homing success and speed. We found that bird species from the family Paridae (chickadees and titmice) were more likely to return to their home territories in winter than Northern Cardinals (*Cardinalis cardinalis*), indicating that species biology could determine strong site fidelity during the non-breeding season. Return speed following translocation was significantly affected by species, canopy cover, and release time. Parids returned faster in landscapes with higher canopy cover. This study is a systematic documentation of strong winter site fidelity and homing in common feeder bird species in North America and provides further evidence that animal movements in the suburban land cover may be constrained by vegetation configuration.

**Feeding on the edge: Foraging White Ibis  
(*Eudocimus albus*) target inter-habitat prey movements**

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The mechanisms of prey production and concentration are crucial biological processes affected by hydrology and landscape features in wetlands. These processes also affect prey exploitation by wading birds. Fish and crayfish prey move down slope within and across wetland habitats as water recedes over the dry season, concentrating prey in optimal foraging patches. Where and how predators exploit concentrating prey depends on movement of prey, predator foraging mode, and water depths. The most abundant nesting wading bird in the Florida Everglades, the White Ibis (*Eudocimus albus*), is a tactile forager that feeds extensively on crayfish. Literature suggests that White Ibis forage in 5-28 cm of water, but observations indicate that crayfish can concentrate at greater depths. We conducted an observational study of White Ibis foraging and crayfish density in drying sloughs to examine this predator-prey interaction. The study took place February-April 2017 in three wetlands at the Loxahatchee Impoundment Landscape Assessment facility in Boynton Beach, Florida. We used time-lapse

imagery to quantify mean White Ibis densities over ~0.16 ha of slough (with adjacent higher elevation ridges) over 61 days. Crayfish densities in the sloughs rose as crayfish moved off drying ridges (4-10 cm). Approximately 60-80% of White Ibis foraging occurred in deep sloughs (30 cm) during the dry down. White Ibis spatial distributions on peak foraging days favored the slough edge (10-12% of a given slough area) with 73-100% of daily foraging birds. Our observations suggest that White Ibis exploit crayfish on the slough edge when most of the slough is too deep for foraging.

**An evaluation of productivity and dispersal for  
Burrowing Owls (*Athene cunicularia*) on the Boca  
Raton campus of Florida Atlantic University**

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A population of the threatened Burrowing Owl (*Athene cunicularia*) lives on the Boca Raton campus of Florida Atlantic University (FAU). The FAU owls use a variety of burrows that vary in their exposure to humans. Detailed information on annual productivity as well as dispersal ranges of mature owls is lacking. This research focused on the dispersal ranges of individuals on the FAU campus and whether fledging rates were similar to those observed by McKie from 1990-2003. We hypothesize that the dispersal range of the burrowing owls should fall be within 2 miles of the natal burrow. We also estimate that the fledging rates will remain similar to those of the 1990's (~80%) even with the decrease in the number of owls. We performed a minimum of 30-minute observations at each burrow site to record activity, quantity, productivity, and dispersal from Fall 2017 to present. Burrowing Owls selected open grassy areas with low vegetation for their burrows. FAU owls also exhibited reproductive trends similar to previous years and demonstrated a low reproduction rate with high fledging rates throughout the year. The FAU campus supported an average of 16 owls during the study with 6 chicks hatched during the breeding period. Only a single chick disappeared before reaching maturity, yielding an 83% fledging success rate. To track individual owls more accurately, we plan to band FAU owls working with the Florida Fish and Wildlife Conservation Commission.

**Do Bachman's Sparrows (*Peucaea aestivalis*)  
match songs with neighbors?**

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Most passerine songbirds sing multiple song types (“song repertoires”) and usually share some song types with other birds in their population. A bird’s song repertoire may contain information about its ability to hold a territory and learn new song types, as well as its overall quality as a mate. During agonistic interactions, male songbirds use their song repertoires and other signaling behaviors to communicate their motivations and intentions. One of these communication signals is known as song-type matching, whereby a male replies to the song of another male with the same song type. Song-type matching has been shown to contain information about a singer’s motivation to escalate an aggressive interaction if the rival does not back down or retreat. We tested hypotheses about song-type matching in Bachman’s Sparrow (*Peucaea aestivalis*). Male Bachman’s Sparrows have large song-type repertoires (45-55 song types) and share song types with territorial neighbors. During the 2018 breeding season, we documented natural bouts of counter-singing between neighbors by placing automated recorders at the territorial boundary between two males. We quantified the song-type matching to determine whether matching occurred at levels greater than those expected by chance. Chance matching rates are low in species with large song repertoires. In combination with results from a field playback experiment, our working hypothesis is that song matching is a signaling behavior that functions between established neighbors and is rarely used during interactions with stranger males. Analyses are ongoing, but to date, male sparrows had higher song rates and type-matching occurrences during playbacks than compared to natural recordings with neighbors. Although our data suggest males type match more frequently during playback experiments, further study is needed to examine whether males type match in an agonistic context during simulated territorial intrusions by neighbors.

## **Wading-bird use of damaged and intact mangrove habitats following Hurricane Irma**

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The coastal avifauna of subtropical regions has evolved within an active tropical storm regime. This study evaluated the impacts of Hurricane Irma on wading birds that forage in mangrove habitats in southwestern Florida. Our study site was Rookery Bay (Collier County) and focused on species of the genus *Egretta* that have experienced declines in Rookery Bay in recent decades (Snowy Egret [*E. thula*], Little Blue Heron [*E. caerulea*], and Tricolored Heron [*E. tricolor*]). We also studied Great Egrets (*Ardea alba*) because this species has served as an indicator species at Rookery Bay in the past. Our objectives were to compare wading bird abundance and foraging activity in the Rookery Bay National Estuarine Reserve and the Ten Thousand Islands National Wildlife Refuge to evaluate how wading birds utilized the mangrove habitats. These areas were selected because the Ten Thousand Islands showed a noticeable loss of mangrove habitat after Hurricane Irma compared to Rookery Bay. Data collection took place from June 10 to August 10, 2018. Focal wading birds were counted along a transect within each study site, along with whether they were foraging or roosting, their GPS coordinates, water depth if applicable, and the approximate damage, canopy cover and tree height taken from the mangroves the wading birds were utilizing. Initial insights about how wading bird populations fared a year after the storm will be discussed.

## **Nesting White Ibis (*Eudocimus albus*) prey composition at coastal colonies in Everglades National Park**

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Prior to extensive draining and compartmentalization of south Florida wetlands, most wading bird nesting activity occurred in

coastal colonies within the southern freshwater/estuarine ecotones of Everglades National Park (ENP). Wading-bird nesting dynamics in this formerly productive region are being used as an indicator of ecosystem restoration success. The White Ibis (*Eudocimus albus*) is the most abundant wading bird nesting in ENP. Previous diet studies in the central Everglades highlight the importance of crayfish and urban resources to ibis colony energetics. Yet, prey use in the remnant coastal colonies of the southern Everglades remains virtually unknown. We assessed prey composition of provisioned ibis chicks in coastal colonies within ENP in 2017 and 2018 through examination of regurgitated food boluses. Prey use varied significantly between years. In 2017, chick boluses were dominated by four genera of estuarine crabs (75.4% of biomass) with low crayfish use (14.6% of biomass). In 2018, prey use shifted from crabs (26.0% of biomass) toward crayfish and fish (45.0% and 27.7% of biomass, respectively). Nesting effort also varied between years, with 2017 considered average (1,206 peak nests) and 2018 supernormal (31,320 peak nests). Our results suggest that crayfish are important prey for White Ibis nesting in the southern Everglades, especially in years with high nesting effort, but other prey types may contribute to prey composition. Results from this study provide insight into the trophic relationships between White Ibis and their prey in a historically productive region of the Everglades.

**Rate of receding water-level explains variation in nest abundance and survival for a searcher (Snowy Egret, *Egretta thula*), but not an exploiter (Great Egret, *Ardea alba*)**

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Reduced prey availability is hypothesized to be a primary mechanism responsible for the decline of wading bird populations in south Florida and elsewhere. Populations of species that require high prey densities to reproduce (i.e., searchers) have declined in the region, whereas those that do not (i.e., exploiters) have increased. For six breeding seasons (2011-2013, 2015-2017), we measured nest abundance and daily nest-

survival rates (DSR) of a searcher, the Snowy Egret (*Egretta thula*; SNEG), and an exploiter, the Great Egret (*Ardea alba*; GREG), at Lake Okeechobee, Florida. We used a model-selection approach to examine the importance of hydrologic parameters on nest abundance and DSR. We predicted that the rate of receding water would be more important in explaining variance in nest abundance and DSR for SNEG than for GREG because water recession rates are correlated with the high prey densities on which searchers depend. Snowy Egret nest abundance and DSR increased with recession rate, though only when lake stage was high. Recession rate was the most important parameter in SNEG nest abundance and DSR models. GREG nest abundance peaked when lake water levels were moderately high and GREG DSR increased weakly with lake water levels. Recession rates did not influence GREG nest abundance or DSR. The high relative importance of recession rate for nest abundance and survival models for SNEG but not GREG were likely due to differences in their foraging ecology. We hypothesize that differences in foraging ecology are also linked to the opposing population trajectories of the two species.

**Urban and natural wetland-nesting Wood Storks  
(*Mycteria americana*) differ in their response to  
hydrologic conditions: Dietary plasticity of a threatened  
species in response to human-induced landscape change**

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Urbanization is one of the most drastic human alterations to ecosystems world-wide. In south Florida, Wood Storks (*Mycteria americana*) have declined due to human-induced landscape changes that have altered Everglades hydrologic conditions. Despite well-documented sensitivity of storks to human disturbance, storks often forage in artificially created wetlands and nest in urban environments. To assess how storks are responding to urbanization in south Florida, we examined the influence of colony location and hydrologic conditions on diet breadth, productivity, and body condition. Based on foraging theory, we expected diet breadth would increase during suboptimal hydrologic conditions, which is linked to low prey density. Furthermore, if urban storks have access to alternative food sources, we would expect them to have a greater diet breadth and productivity during

suboptimal conditions than storks in natural wetlands. We found that urban storks had greater diet breadth than natural wetland storks. Diet breadth of urban and natural wetland storks was greatest during suboptimal conditions. When conditions were optimal, urban and natural wetland storks exhibited decreased diet breadth. Similarly, productivity varied with hydrologic conditions and colony location. During suboptimal conditions, urban storks had greater productivity when compared to natural wetland storks. During optimal conditions, both urban and natural storks had high productivity with natural wetland nesting storks having the greatest productivity. Overall, body condition of nestlings did not differ significantly between natural and urban storks. However, body condition was significantly higher for all storks during optimal conditions. Overall, urban storks had greater diet breadth and productivity than natural wetland storks, suggesting that urban storks may be more resilient to hydrologic fluctuations than Everglades nesting storks. The increased diet breadth of urban storks may be due to proximity of alternative food sources associated with artificially created wetlands and urban refuse that provide more predictable food sources when natural wetlands are suboptimal.

**Importance of patch-specific data in assessing the risk of extinction for the Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*), a federally endangered raptor**

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The Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*) lives year-round in a dynamic patchwork of wetlands in south Florida where it feeds predominantly on apple snails (*Pomacea* spp.). Despite decades of intensive species- and ecosystem recovery efforts, this population of the Snail Kite remains endangered, although its population size has increased recently concomitant with an invasion by a non-native apple snail, *Pomacea maculata*. Our study tested the hypothesis that the proliferation of *P. maculata* is contributing to a recovery of the kite population. We conducted a population viability analysis (PVA) for the entire population and for two subpopulations (northern wetlands vs.



southern wetlands) both before and after the invasion of *P. maculata*. Though the probability of extinction within 50 years remained at zero in all PVA models, the projected growth rate of the whole population was slightly lower in the invasion era ( $r = 0.001$ ) compared to the pre-invasion era ( $r = 0.039$ ). This suggests that *P. maculata* alone cannot sustain the recovery of the Everglade Snail Kite. However, the sub-population PVAs showed that the growth rate of Snail Kite sub-populations is most positive in the northern wetlands where *P. maculata* is most abundant, which suggests conditions in the declining southern sub-population were severe enough to mask positive effects of the new prey in the statewide analysis. We illustrate how the scale of analysis, even in a small, wide-ranging, oft-dispersing species, may have important consequences for endangered species management.

### **Exploratory behavior of reintroduced Brown-headed Nuthatches (*Sitta pusilla*)**

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Reintroducing animals to habitats they once occupied has emerged as an important conservation strategy in the face of anthropogenic habitat loss and climate change. Despite widespread implementation, very few reintroduction efforts are deemed successful. Qualifying reintroductions as a success has focused primarily on census and demographic data with less consideration given to the potential role that behavior may play in reintroduction. Brown-headed Nuthatches (*Sitta pusilla*) were successfully reintroduced to restored pine rockland habitat in Everglades National Park in the early 2000s. Our objectives were to determine behavioral factors that may have been important to success of reintroduction efforts by comparing personality types in the reintroduced population ( $n = 18$ ) with personality types in the original source population ( $n = 17$ ) used for the reintroduction and another nuthatch population in north Florida ( $n = 17$ ). We placed birds in an exploratory chamber and observed each bird for 10 minutes, quantifying how quickly or slowly they explored a novel environment. We found that reintroduced nuthatches in the Everglades exhibited

slower exploratory tendencies compared to the other populations assessed. These results could help to inform future reintroduction efforts for nuthatches and other species.

**A collaborative approach to monitoring  
regional dispersal dynamics of Black Skimmers  
(*Rynchops niger*) in southwest Florida**

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Monitoring seabirds is a valuable approach to gauge the ecological integrity of Florida's coastline. For example, the colonial-breeding Black Skimmer (*Rynchops niger*) is a conservation priority throughout Florida owing largely to the threats associated with intensive development of beaches where it breeds. Many gaps exist in surveying the expansive southwest coastline of Florida where large breeding skimmer colonies exist, especially during fall and winter after colonies have disbanded. The objective of this study was to fill in knowledge gaps by documenting movements of individually marked skimmers after they fledged from breeding colonies. Our focus was tracking regional skimmer distributions across widely scattered areas in Collier, Lee and Charlotte counties, building on banding efforts in Pinellas County (since 2015) and Collier County (since 2017). Using a combination of complementary techniques, we augmented survey effort in terms of spatial and temporal coverage. The use of multiple approaches was accomplished with help from undergraduate student researchers who were conducting their Senior Research projects focused on various aspects of the study. Techniques employed included traditional band re-sighting, targeted surveys in likely areas of skimmer congregation, concerted scouting in under-covered areas, and manual and automated radio-tracking of chicks outfitted with VHF nanotags. In July-August 2017 and 2018, banding and nano-tagging of ~3-week old chicks occurred at St. Pete Beach and Indian Shores (Pinellas County) and Tigertail Beach on Marco Island (Collier County). Since summer 2018, monitoring efforts have included rotating weekly

surveys among over a dozen sites, spanning south to north from the 10,000 Islands to St. Pete Beach. We will provide highlights of our preliminary observations, and monitoring will continue this fall and winter. Ultimately this study will augment knowledge about regional movement patterns of Black Skimmers to facilitate conservation planning. It also demonstrates the efficacy and value of collaborative research with university students.

### **Foraging behavior of provisioning Roseate Spoonbills (*Platalea ajaja*) in Florida Bay**

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Roseate Spoonbills (*Platalea ajaja*) breeding in Florida Bay forage in Everglades National Park's coastal dwarf mangrove habitats. Due to foraging habitat degradation elsewhere in south Florida, their nesting colony range has increased throughout the Bay since 1936 as spoonbills found new foraging habitats. In 2006, Roseate Spoonbills began nesting in large numbers in Madeira Hammock in inland Everglades National Park. In this study, ten Roseate Spoonbills breeding in Florida Bay will be satellite tagged and tracked for one breeding season. A fishnet analysis will determine foraging habitats from this study and from a previous satellite study conducted from 2005 to 2007. Foraging habitats and foraging behavior, including foraging flight distance and duration will be compared. Results from the 2005 to 2007 study showed Roseate Spoonbills flying an average of 12 km between nesting colony and foraging sites with a maximum flight distance of 65 km. Primary foraging sites during those years were located north of Florida Bay from Taylor Slough to Turkey Point. We expect to see a relationship between these foraging behaviors and water levels. Roseate Spoonbills are tactile feeders and require a high concentration of fish to forage successfully. If primary foraging habitats do not dry down to a water level below 13 cm, spoonbills may be forced to forage elsewhere resulting in increases in foraging distance and duration.

## **How vigilance behavior of Burrowing Owls (*Athene cunicularia*) is influenced by human development**

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Research about the natural and life history of the Burrowing Owl (*Athene cunicularia*) is imperative to inform management decisions that will protect this threatened species in Florida. This study aims to augment the understanding of Burrowing Owl ecology by evaluating whether urban density influences the type and overall amount of vigilance behavior exhibited in a population in Cape Coral, in southwest Florida. Cape Coral has been and continues to be one of the fastest growing cities in Florida. We predicted there would be differences in the types of vigilance behavior displayed between owls in North Cape Coral and those in South Cape Coral because of different development intensities. A time-budget analysis was conducted to compare vigilance at owl burrows in dense versus less developed parts of the region. We studied three burrows located in North Cape Coral where human density was lower and three burrows located in South Cape Coral where human density was higher. Each site was observed on five days during Summer 2018; owl behavior was categorized every 15 seconds for a total of 20 minutes of observations at each burrow per day. Behaviors were recorded in categories of the most common types, including perching, preening, looking around, and looking up. The results show that burrowing owls in the North Cape spend more time looking towards the sky than burrowing owls in the South. This could suggest that owls in the South Cape are vigilant for different predators, such as domestic cats or dogs and vehicles, compared to those in the North. This relationship between the amount of urban density and vigilance behavior could have implications on future conservation management plans for this species.

## **Video-documentation of predators and nest defense at Bachman's Sparrow (*Peucaea aestivalis*) nests**

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Nest predation is often a factor contributing to avian population declines, but its influence can vary with predator type and parental nest-defense behaviors. Successful management of declining bird populations, therefore, requires characterization of predator identity and nest-defense behaviors. We focus on predation patterns at nests of Bachman's Sparrow (*Peucaea aestivalis*), a species of conservation concern that is endemic to pine savannas of the southeastern United States and whose nesting ecology is insufficiently described. During 2015-2017, at two sites in northern Florida, we monitored 86 Bachman's Sparrow nests, 65 with constant video surveillance. We identified 12 predator species from 37 predation events. Snakes were the dominant predator type, responsible for 51% of identified predation events, followed by mesomammals (19%), small mammals (16%), and other species (14%). We observed six instances of nest defense behavior by parents. Nest defense behavior included ptiloerection and chasing, which was rare (16% of predation events) and effective 67% of the time. Daily nest survival was 0.936 (CI: 0.894-0.967) and neither season, year, nor site explained a significant amount of variation in estimates of cause-specific daily nest mortality. Raccoons were not detected at Bachman's Sparrow nests despite being one of the most common nest predators in other avian nest-surveillance studies. Given that pine savannas of the southeastern United States are fire-dominated, we suggest that the effects of fire on snake activity and foraging patterns in southeastern grasslands deserves further research.

**Time and tide wait for no bird: Predicting Little Blue Heron (*Egretta caerulea*) habitat use in a dynamic intertidal system**

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Wading birds are limited to foraging in water depths no deeper than their leg length (0-50 cm) and consequently tides restrict when and where they can feed. We identified factors affecting density of foraging Little Blue Herons (*Egretta caerulea*) in intertidal systems. We performed bi-weekly surveys by boat within Great White Heron National Wildlife Refuge, Florida Keys, from 2016-2018 to locate birds foraging in intertidal areas during the breeding season (February-July). We used these data to evaluate the predictive performance of an established model for Little Blue Heron density that evaluates the effects of shallow-water availability (SWA), spring-neap tidal cycle, diurnal activity, and ebb-flood tidal cycle. The model suggested good fit of the data ( $R^2 = 0.42$ ) but over-predicted densities at low and high values. We then tested whether breeding activity was a predictor of foraging density when nestlings were present and one adult tended nestlings while the other adult gathered food. This formulation retained parameters from the established model and included a parameter for breeding activity (quadratic form) to predict density using Akaike's Information Criterion (AICc) model-selection approach. The top three competitive models based on delta AICc < 2 carried 67% of the weight and included parameters for breeding activity, diurnal activity, and spring-neap tidal cycle. There was a strong quadratic effect of breeding activity on density, indicating that foraging activity of Little Blue Herons is predominantly constrained by breeding activity with density in foraging habitat dropping during periods of incubation and chick-provisioning. The weak effect of shallow-water availability and ebb-flood tidal cycle suggested that their influence on Little Blue Heron density was suppressed during the breeding season when nesting pairs were under pressure to increase foraging activity.

**Review of American Flamingo  
(*Phoenicopterus ruber*) natural history in Florida**

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The American Flamingo (*Phoenicopterus ruber*) is an iconic Florida symbol used to promote tourism, lottery tickets, and other Florida oddities. For nearly a century, the status of this species in Florida has been controversial. Historical populations and long-term trends of flamingos have been misunderstood. Additionally, there has been uncertainty regarding historical breeding and whether nesting occurred, or whether current flamingo observations are wild or escapee birds. We aim to understand the historical status and long-term trends of the American Flamingo in Florida for management purposes. Early naturalist and museum records allowed us to compile historical information that described the historical abundance and distribution. Contemporary citizen science projects and rare-bird reports were also collected to look for recent trends. The records showed definitive evidence for large flamingo flocks (hundreds to thousands of individuals) present year-round in the 19th century. Historical flocks experienced heavy hunting pressures, and there is strong evidence that hunting led to extirpation of the historical population by 1900. From 1950 to 2015, citizen-science data showed increasing population trends, potentially indicating incipient recolonization of their historic range. Resolution of the status and origin of Florida's flamingos is a critical foundation for science-based management planning.

**Spatial pattern of song sharing in Bachman's Sparrows (*Peucaea aestivalis*)**

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Song sharing is common among male songbirds, but the extent of song sharing among individuals can vary depending on the geographical distance between territories. This variation is due to differences in dispersal distances combined with specific song-learning periods. Thus, comparing spatial patterns of song sharing allows us to infer song-learning strategies and dispersal behavior for even the rarest or most secretive species. The extent of song learning and dispersal are unknown for the rare Bachman's Sparrow (*Peucaea aestivalis*), most likely because it spends much of its life hidden in the understory of pine flatwoods and prairies. Our objective was to compare the number of songs shared among male Bachman's Sparrows to understand broad patterns of song development and dispersal. From 2016 to 2018, we recorded adult male sparrows using targeted recording and long-term acoustic recorders, and we marked their locations. We determined their repertoires using a program developed in *Matlab* and compared repertoires between males by visually comparing song spectrograms. Song sharing is greater at closer distances, especially for neighbors, and then declines at greater distances. These data suggest that Bachman's Sparrows may be age-restricted learners, and that they attempt short dispersal distances but will disperse farther if suitable territories are not available. By understanding how these imperiled songbirds disperse, we can make better decisions about conserving their populations.



**Comparison of monitoring approaches for avian communities in freshwater wetlands: Bio-acoustic versus conventional point-count methods**

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Wetlands are known for their high levels of biodiversity and biological productivity. They provide important functions and ecosystem services that include productivity, biodiversity support, nutrient cycling, and floodwater storage. Birds may be affected by all four types of ecosystem services. Monitoring of bird distribution and abundance, in turn, can detect changes in relation to ecosystem functions as well as more specific features such as habitat availability and surrounding land uses. In this research, my goal is to compare the accuracy of three monitoring approaches in common use today for surveying wetland bird communities. I will deploy a variety of Acoustic Diversity Indicators (ADIs) to assess whether data collected using these devices are correlated with bird community richness and health. After assessing three distinct methods (alone and in combination), I will develop an adaptive monitoring protocol for wetland avian diversity and community functions using optimal combinations of techniques.

**Partial migration and seasonal distribution patterns in Wood Storks (*Mycteria americana*)**

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Wood Storks (*Mycteria americana*) are federally threatened wading birds in the southeastern U.S., historically nesting mainly in the Florida Everglades. High mobility is a key feature that allows wading birds to exploit resources whose distributions are both spatio-temporally heterogeneous and unpredictable. Patterns of Wood Stork large-scale migratory movements are likely to reflect spatiotemporal dynamics of resource availability across their range but have never been described in detail. The objective of this study was to provide

the first quantitative, individual-based description of Wood Stork migratory patterns and seasonal distribution. Using GPS tracking data for 64 individuals tracked between 2004 and 2017, we found that the Wood Stork population was partially migratory, with 59% of individuals seasonally commuting between winter ranges in Florida and summer ranges elsewhere in the population range (migrants), and 28% remaining in a single area in Florida year-round (residents). Additionally, 13% of storks act as opportunistic migrants, migrating in some years but not in others. Partial migration is likely an adaptation to high heterogeneity and unpredictability of food resources. Comparing the distribution of residents and migrants suggests that different migratory strategies might be associated with the use of different or differently distributed resources, possibly including food supplementation from human activities. The existence of opportunistic migrants shows the potential for plastic change of migratory patterns on top of adaptation. Our future research focuses on the fitness implications of migratory behavior, to improve our understanding of the ecological and evolutionary drivers of partial migration.

### **Variation in parid call production during mobbing events in Florida**

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In various ecosystems, mobbing continues to be a significant anti-predator mechanism utilized by prey against predators. In forests of the eastern U.S., Tufted Titmice (*Baeolophus bicolor*) and Carolina Chickadees (*Poecile carolinensis*) act as nuclear species, possibly using their sociability and aggression to aid their success in predator mobbing. Parid mobbing calls can vary in complexity, though the cause of this variation is still unknown. Thus, this investigation examined potential causes for these changes. In multiple plots within three distinct sites in Florida, audio recordings were made during mobbing aggregations created by a playback of an Eastern Screech Owl (*Megascops asio*). The parid calls were marked and counted on each of the recordings, while the number of heterospecifics and core species (Tufted Titmice, Carolina Chickadees, Downy Woodpeckers [*Picoides pubescens*], and

White-breasted Nuthatches [*Sitta carolinensis*] present were noted. The findings suggest a positive relationship between the presence of the core species and the parid call count, as well as a positive relationship between the number of parids present and the parid call count. The number of heterospecifics present does not appear to influence the parid call count substantially. The findings also suggest that the threat of detection also influences call production. Therefore, the presence and number of Downy Woodpeckers, White-breasted Nuthatches and parids in mobs as well as the threat of detection may influence the complexity of parid mobbing calls.

### **Composition of disturbance factors at a Black Skimmer (*Rynchops niger*) colony in southwestern Florida**

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This study evaluates the relative impact of disturbance factors on two Black Skimmer colonies at Tigertail Beach on Marco Island, Collier County, Florida. The Black Skimmer (*Rynchops niger*) is a seabird in the family Laridae that forages on small fish and crustaceans by skimming the water's surface with its signature asymmetric bill. Habitat loss due to beach erosion and development has contributed to population decline of this state threatened, beach-nesting species, and growing outdoor recreation and Fish Crow (*Corvus ossifragus*) predation are other potential sources of disturbance. Disturbance can be defined as any action that disrupts the breeding cycle, foraging behaviors, or resting of shorebirds. Actions that disrupt breeding behaviors have been shown to cause egg- and chick mortality in skimmers, yet no known previous research has evaluated disturbance behavior in Florida's breeding populations. During the 2017 breeding season, we monitored skimmer responses to disturbances at this site that has consistently supported one of the largest colonies of breeding Black Skimmers and Least Terns (*Sternula antillarum*) in Florida. Our objective was to quantify the composition of disturbances affecting the colony and to determine which sources caused the highest frequency and intensity of behavioral responses. The two colonies were observed for a minimum of two days/week from the onset of courting until chicks fledged. We noted all sources of activity that elicited vocal or flushing responses from the breeding birds. Response variables included the approximate

percentage of adults participating in disturbance behavior and the amount of time spent performing displays. Preliminary comparison of the sources of activity indicates that human-caused versus other sources of disturbance, such as the presence of predators, were equally frequent. Our data about the types, relative frequency, and intensity of different disturbances will provide insights for conservation and public education purposes at the Tigertail colony, along with related management and regulatory purposes with implications for seabird colonies throughout Florida.

**Linking territory characteristics to behavioral syndromes  
in Bachman's Sparrow (*Peucaea aestivalis*)**

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Behavioral syndromes are suites of correlated behaviors expressed by individual animals within or across behavioral contexts. For example, individuals that are more aggressive when confronting rivals are often bolder when confronting novel objects. Because behavioral syndromes can predict how individuals respond to environmental stimuli (e.g., food shortage, increased predation threat), habitat-management strategies may favor individuals with certain behavioral syndromes, thus affecting how the population responds to the management practices. We tested for a behavioral syndrome linking aggression and boldness in male Bachman's Sparrows (*Peucaea aestivalis*) and asked whether these traits correlated with aspects of territory quality. We predicted that 1) males that were more aggressive in response to rivals would also be bolder when approached by a human, and 2) aggression/boldness would show a positive relationship with territory quality. We studied male sparrows breeding in Jonathan Dickinson State Park, Florida, from March-July in 2018. For each male we measured boldness (flight initiation distance) and aggressiveness (simulated territorial intrusion using song playback and a sparrow decoy) to test for positive association between these traits. We also mapped each male's territory and estimated territory size, percent wetland cover, basal area of woody material, time since last fire, and the density and height of vegetation. Our analysis uses generalized linear models to describe the relationship between behavioral traits (boldness and aggression) and territory characteristics. Our results will add to

an understanding of how behavioral traits and their resulting social dynamics shape individual space use in a population, with future research directed at incorporating this relationship into population modeling and conservation management strategies.

**Conserving suburban Burrowing Owls  
(*Athene cunicularia*) by engaging residents**

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Burrowing Owls (*Athene cunicularia*) on Marco Island (Collier County) are integrated with the community and can be found nesting on vacant lots in almost every neighborhood. Though their population currently numbers around 190 pairs, they are threatened by habitat loss as vacant lots are developed into new homes. To address future concerns about Marco Island's Burrowing Owls, we implemented two community-based conservation programs. *Owl Watch* is a citizen-science project in which volunteers monitor Burrowing Owl nests throughout the nesting season. In 2018, 46 residents participated in *Owl Watch*, and conducted a total of 4,500 10-minute observations of 193 pairs of Burrowing Owls, contributing 760 hours of service. Productivity estimates from *Owl Watch* data were not significantly different from productivity determined by professional researchers. *Owl Watch* citizen scientists provided an effective way of collecting data over greater space and time than a single researcher, and we plan to continue *Owl Watch* to track any potential population changes over time. A second conservation program associated with *Owl Watch* encouraged landowners to install starter burrows on their property with the intention of attracting Burrowing Owls. In 2018, forty-one landowners participated and allowed us to dig one or more starter burrows on their property. Of the 50 starter burrows dug, ten had evidence of Burrowing Owls digging, five were excavated by owls into full burrows and used as accessory burrows, and two were used as nests. Additional study is necessary, but starter burrows may have potential to provide additional nesting habitat to Burrowing Owls as vacant lots containing existing burrows are developed.

**White Ibises (*Eudocimus albus*) as urban  
adapters in south Florida**

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Novel anthropogenic food resources can alter species' ecology, health, and behavior. The White Ibis (*Eudocimus albus*) is a great model species to study recent urban adaptation, as a portion of the south Florida population has recently shifted from a wetland specialist to a generalist within the last two decades. Ibises in Florida are commonly observed in urban areas where they forage on lawns, landfills, and golf courses, and are also hand-fed in urban parks. We have been studying the effects of this recent urbanization on White Ibises since 2009, hypothesizing that ibises were spending more time in urban areas than in natural areas, showing higher site fidelity to urban parks and zoos where food handouts were abundant, and questioning the effects the shift in behavior had on their health (e.g., body condition, ectoparasite burdens, stress, immunity, and pathogen prevalence) where they consume largely carbohydrate-rich and protein-poor diets. From 2015 to 2017, we captured ibises both within the urban landscape and natural wetlands, collected biological samples, and attached GPS transmitters to a subset of adults. Our results suggest that ibises in urban areas showed higher site fidelity throughout the non-breeding season and were heavily provisioned with anthropogenic food, which appeared to offer a trade-off by providing low-quality, but easily accessible calories that may not support high mass but may increase time available for behaviors such as preening that decrease ectoparasites. Furthermore, urban ibises are more likely to be chronically stressed and to have a higher parasite (*Salmonella*) prevalence than birds captured at natural sites. Parasite prevalence was also positively associated with fidelity to sites from which we had isolated *Salmonella* spp. Understanding the trade-offs ibis face is important for future conservation and management of birds in human-modified habitats.

## Habitat use, range size, and residency times of an American Flamingo (*Phoenicopterus ruber*) in Florida Bay

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American Flamingos (*Phoenicopterus ruber*) are among the rarest and most iconic of Florida's birds. Flamingos were nearly extirpated from south Florida by ~1900, but flamingo observations have been increasing since the 1950s, likely as increasing numbers of birds arrive in Florida from growing breeding populations in the Caribbean. To date, no detailed ecological studies of Florida's flamingos have been conducted and exact geographic origins of flamingos in Florida remain unclear. In 2015, we captured, banded, and placed a satellite transmitter on a juvenile male American Flamingo (band US01, hereafter "Conchy"). Here, we report satellite telemetry results from over a two-year period in an effort to evaluate geographic origins, habitat use, range size, and residency times of flamingos in Florida. Between November 2015 and October 2017, Conchy used a range of mud flats, mud banks, and lagoons within Florida Bay. Conchy resided largely within the confines of Everglades National Park for a period of two years—ultimately providing no information on a connection between Florida's flamingos and populations elsewhere in the Caribbean. Conchy was reported in multiple instances through the *eBird* citizen-science project, providing valuable information on detection probability for putatively conspicuous birds. Although our data and observations are all generated from a single individual bird, they provide useful information on basic biology of one of Florida's most charismatic bird species.

**Testing hypotheses about song-type matching  
and song sequences in Bachman's Sparrow  
(*Peucaea aestivalis*) vocal repertoires**

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To extract meaning from a communication signal, animals must understand both the context of the communication (e.g., intrasexual competition or courtship) as well as how an individual's vocal units are organized and delivered. In this project we aim to understand how Bachman's Sparrows (*Peucaea aestivalis*) structure the delivery of their large *primary* song type repertoires (> 45 song types) and the potential role that song delivery patterns play in intraspecific vocal interactions. In a field study we presented male Bachman's Sparrows with simulated territorial intrusions and each subject received two song playback treatments: 1) songs played in the sequence in which the subject bird sang them during a natural bout of undisturbed broadcast singing (ABCDE), and 2) songs played in a jumbled order (e.g., CEADB). We compared responses to the two playback treatments and found no differences in song type matching, song rate, song type switching frequency, or aggressive behaviors. While there was a low incidence of song type matching during both treatments, subjects tended to match song type to the playback more frequently when songs were presented in the birds' own sequence (the song sequence produced during undisturbed broadcast singing) compared to songs played in a jumbled sequence. In ongoing analyses, we are using Markov models to test for predictable song delivery patterns in individual Bachman's Sparrows during undisturbed singing, in response to simulated territorial intrusion, and during natural counter-singing interactions between neighbors. We will also test whether neighbor dyads, which tend to share song types in common, also share song sequences in common. Ultimately, we seek to understand the role that vocal unit sequences may play in agonistic communication.